

CLAIMS

- 1        1. An energy reclamation system for harvesting energy from ambient radio
- 2        frequency (RF) signals, comprising:
  - 3            a first subsystem having at least one antenna for receiving ambient RF signals;
  - 4            a second subsystem having circuitries for converting RF energy from the
  - 5        received ambient RF signals to DC electrical power; and
  - 6            a third subsystem having a power storage device for storing the converted DC
  - 7        electrical power as charged by the second subsystem.
- 1        2. The energy reclamation system of claim 1, wherein the at least one antenna
- 2        comprises an array of antennas.
- 1        3. The energy reclamation system of claim 1, wherein the at least one antenna
- 2        comprises a wideband, omni directional antenna optimized to receive the ambient RF
- 3        signals in a selected frequency range.
- 1        4. The energy reclamation system of claim 2, wherein each antenna in the
- 2        array of antennas comprises a wideband, omni directional antenna optimized to
- 3        receive the ambient RF signals in a selected frequency range.
- 1        5. The energy reclamation system of claim 2, wherein each antenna in the
- 2        array of antennas is optimized to receive the ambient RF signals in a selected
- 3        frequency that is different from that of another antenna in the array of antennas.

1       6. The energy reclamation system of claim 1, wherein the circuitries of the  
2 second subsystem is formed on an application specific integrated circuit (ASIC) chip  
3 that is integrated with the at least one antenna for converting the RF energy to DC  
4 electrical power.

1       7. The energy reclamation system of claim 1, wherein the circuitries of the  
2 second subsystem comprises:

3           a rectifier for converting the RF energy into DC electrical power; and  
4           a trickle charger for charging the DC electrical power to the battery or power  
5 storage device of the third subsystem.

1       8. The energy reclamation system of claim 1, wherein the power storage  
2 device comprises a plurality of battery micro-cells.

1       9. The energy reclamation system of claim 1, wherein the battery of the third  
2 subsystem comprises an NxM array of battery micro-cells, wherein N and M are  
3 natural numbers.

1       10. The energy reclamation system of claim 9 wherein the battery micro-cells  
2 are charged with the converted DC electrical power on a cell by cell basis.

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1       11. An energy reclamation system for harvesting ambient energy, comprising:  
2           a first subsystem for harvesting two or more different types of ambient energy;

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- 3           a second subsystem for converting the harvested ambient energy into DC
- 4   electrical power; and
- 5           a third subsystem for storing the DC electrical power.

1           12. The energy reclamation system of claim 11, wherein the first subsystem  
2   comprises:

- 3           a first transducer having at least one antenna for receiving ambient RF energy
- 4   and converting the RF energy to electrical energy; and
- 5           a second transducer for receiving ambient energy of a type different from the
- 6   RF energy.

1           13. The energy reclamation system of claim 12, wherein the second  
2   transducer comprises:

- 3           a solar energy conversion device for receiving ambient solar energy and
- 4   converting the solar energy to electrical energy.

1           14. The energy reclamation system of claim 13, wherein the solar energy  
2   conversion device comprises an array of solar cells.

1           15. The energy reclamation system of claim 12, wherein the second  
2   transducer comprises:

- 3           an acoustical energy conversion device for receiving ambient acoustical
- 4   energy and converting the acoustical energy to electrical energy.

1        16. The energy reclamation system of claim 15, wherein the acoustical energy  
2 conversion device comprises a piezoelectric transducer.

1        17. The energy reclamation system of claim 12, wherein the second  
2 transducer comprises:

3            a mechanical energy conversion device for receiving ambient mechanical  
4 energy and converting the mechanical energy to electrical energy.

1        18. The energy reclamation system of claim 17, wherein the mechanical  
2 energy conversion device comprises a transducer for transducing mechanical energy  
3 derived from a natural acceleration of an object or person while in transport or in use.

1        19. The energy reclamation system of claim 12, wherein the at least one  
2 antenna is also for receiving RF energy from an intended RF power source.

1        20. A wireless communication apparatus comprising:  
2            a first antenna for receiving communication signals;  
3            a second antenna for receiving ambient radio frequency (RF) signals;  
4            communication processing circuitry for processing the communication signals;  
5            a first power source for powering the communication processing circuitry;  
6            an energy conversion subsystem for converting the ambient RF signals into  
7            DC electrical power; and

8           an energy storage subsystem for storing energy charged by the DC electrical  
9    power, wherein the energy storage subsystem provides power to the first power  
10   source.

1           21. The wireless communication apparatus of claim 20, further comprising:  
2           a switching circuitry for receiving an activation signal; and  
3           a monitor and activation circuitry for receiving the activation signal from the  
4    switching circuitry.

1           22. The wireless communication apparatus of claim 21, wherein the switching  
2    circuitry receives the activation signal from the first antenna.

1           23. The wireless communication apparatus of claim 21, wherein the monitor  
2    and activation circuitry enables the switching circuitry to electrically connect the first  
3    antenna to the communication processing circuitry.

1           24. The wireless communication apparatus of claim 21, wherein the energy  
2    storage subsystem provides power to the monitor and activation circuitry.

1           25. The wireless communication apparatus of claim 21, wherein the energy  
2    storage subsystem provides power to the switching circuitry.

1        26. The wireless communication apparatus of claim 20, wherein the DC  
2        electrical power is further provided to the first power source.

1        27. The wireless communication apparatus of claim 20, wherein the first  
2        antenna is also for receiving the ambient RF signals, and the second antenna is also  
3        for receiving the communication signals.

1        28. A method for harvesting and utilizing electromagnetic energy,  
2        comprising:

3        receiving ambient electromagnetic energy;  
4        converting the ambient electromagnetic energy into DC electrical power; and  
5        charging a power storage component with the DC electrical power.

1        29. The method of claim 28, further comprising:

2        providing the DC electrical power to a device power source for powering an  
3        electrical device once the power storage component is completely charged.

1        30. The method of claim 28, wherein the power storage component comprises  
2        a NxM array of battery micro-cells, wherein N and M are natural numbers.

1        31. The method of claim 30, further comprising:

2        providing a device power source for powering an electrical device; and

3            drawing power from the power storage component to power the electrical  
4    device.

1            32. The method of claim 31, wherein drawing power from the power storage  
2    component to power the electrical device comprises:

3            determining a charged PxQ sub-array of the NxM array of battery micro-cells,  
4    wherein P and Q are natural numbers less than N and M, respectively; and  
5            drawing power from the charged PxQ sub-array to power the electrical device.

1            33. The method of claim 32, wherein charging the power storage component  
2    with the DC electrical power comprises:

3            charging at least one remaining micro-cell of battery in the NxM array that is  
4    not in the charged PxQ sub-array;  
5            substituting the PxQ sub-array with the at least one remaining micro-cell of  
6    battery once the PxQ sub-array is depleted of power; and  
7            charging the depleted PxQ sub-array with the DC electrical power.

1            34. The method of claim 33, wherein drawing power from the power storage  
2    component to power the electrical device further comprises:

3            drawing power from the at least one remaining charged micro-cell of battery to  
4    power the electrical device.

1           35. The method of claim 31, wherein the ambient electromagnetic energy is  
2 received by at least one antenna.

1           36. The method of claim 35, wherein the at least one antenna and the power  
2 storage component are physically apart from the electrical device.

1           37. The method of claim 28, further comprising:  
2           providing a device power source for powering an electrical device;  
3           drawing power from the power storage component to power the electrical  
4 device; and  
5           wherein the power storage component is located at a physical structure  
6 different from that of the electrical device.

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